

# Credit and Borrowing

FM4 HSC

GENERAL MATHEMATICS























**NAME:** \_\_\_\_\_

## HSC CAPACITY MATRIX - GENERAL MATHEMATICS

### TOPIC: Financial Mathematics 4 - Credit & Borrowing

2 weeks

CONTENT	CAPACITY BREAKDOWN!	DONE IT!!!!	GOT IT!!!!	ON MY WAY!	WORKING ON IT!	HELP!!!!
1. Calculations of principal, interest and repayments for flat rate loans	Ex 1A Q5 onwards					
2. Calculation of values in a table of home loan repayments	Ex 1B Q3 - Spreadsheet Home Loan					
3. Comparison of different options for borrowing money applying the effective rate of interest	Ex 1CQ1a-4a, 5-12					
4. Credit card payments, incorporating fees, charges, rates and interest-free periods	Ex 1D Credit card research task					
5. Using tables from financial institutions to determine monthly repayments	Ex 1E					

### Your say!

What was the most important thing you learned? \_\_\_\_\_

What was something new you learnt? \_\_\_\_\_

What part(s) of this topic will you need to work on? \_\_\_\_\_

# Flat Rate Loans aka Simple Interest...

**YOU HAVE DONE THIS BEFORE AND BEFORE AND BEFORE AND....**

## SO LET'S REHASH.

The formula (as you know it)	The formula on the Formulae Sheet

## THE VARIOUS WAYS THE FORMULA CAN BE APPLIED

## 1. Basic –

Calculate the simple interest on \$5 000 at 2.25% pa for 12 years.

Calculate the simple interest on \$5 000 at 1.5% six monthly for 12 years.

## 2. Manipulating the formula –

Calculate the number of years that \$7 000 would need to be invested to receive \$4 200 in simple interest.



Calculate the interest rate (per annum) that must be applied to \$10 000 over 10 years to earn \$8 000

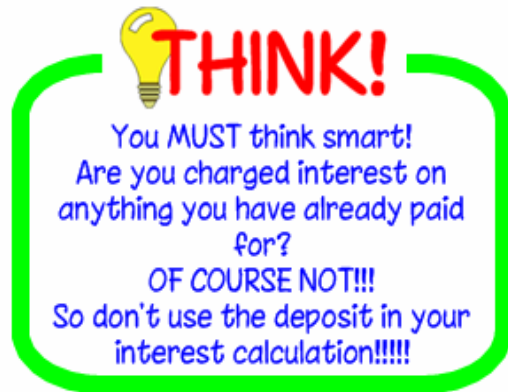
### 3. Applying the formula as a FLAT RATE LOAN –

Caitlin purchases a lounge for \$5 500 using the credit process of the store. This involves a deposit of 10% of the original price then equal fortnightly repayments over 2 years which includes 12% pa interest charged on the balance.

a) What is the deposit Caitlin pays for the lounge;

b) Calculate the interest charged for the two years;

c) Calculate the cost of the fortnightly repayment.



# Housing Loan Tables

## Investigating a reducible interest loan

eg Luke borrowed \$530 000 to buy an apartment. The interest rate is 7.5% p.a.  
Interest is calculated every month on the balance owing and Luke will repay .

**Task 1:** Use your calculator to complete the next 6 rows in this table:

Month	Rate	Opening Balance	Interest	Instalment	Closing Balance
Write how you would calculate each column					
1	7.5	530 000	3312.50	3 916.65	529 395.90
2	7.5	529 395.90	3308.72	3 916.65	528787.90
3	7.5			3 916.65	
	7.5			3 916.65	
	7.5			3 916.65	
	7.5			3 916.65	
	7.5			3 916.65	
	7.5			3 916.65	



**NOTE:** The table assumes the same number of days in each month ie 12 months = 1 year.

**Task 2:**

Build this spreadsheet and continue it until the loan is repaid in full.

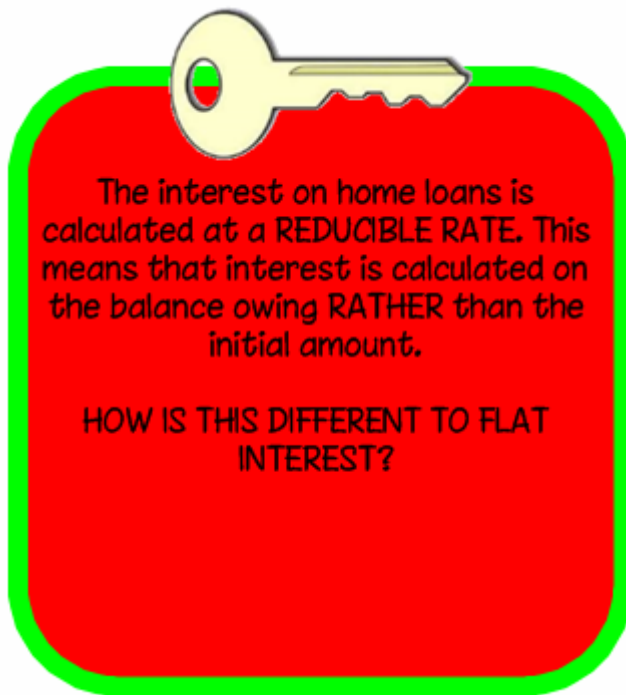
Include a cell with a SUM formula that can calculate the total amount of interest paid.

**Task 3:**

- How many years does it take to re-pay the loan?
- At what year is the loan reduced to half?
- Use Excel to draw a graph that shows the amount owing falling as time progresses.
- Describe the graph.



# REDUCIBLE LOANS



eg A loan of \$120 000 is paid off at 9%pa reducible interest over a period of 25 years. The monthly repayment is \$1 007.04. Calculate the total interest paid.

**INVESTIGATION:** You have saved \$20 000 for a deposit on a unit. Given that lending institutions expect the deposit to be 10% of the house price, you need to borrow \$\_\_\_\_\_.

You can reasonably pay \$500.00 a month as an instalment.

Now research three different lending institutions and complete the following:

- Find their current reducible interest rate.
- Create a spreadsheet for each lending institution that displays the following and continue it until each loan is repaid in full:

LENDING INSTITUTION:					
Month	Rate	Opening Balance	Interest	Instalment	Closing Balance

- Calculate the difference in cost between the most expensive and least expensive.

1. Calculate the total amount of repayments made in the first year.
2. Compare your answer in Question 5 with the final balance of your table and comment on the impact of the repayments for the year.
3. Check to see if your loan has any extra fees and calculate their cost for the first year.

## TIPS TO REMEMBER!

1. The interest on home loans is calculated at a reducible rate. This means that the interest is calculated **on the balance owing** rather than the initial amount borrowed.
2. Interest is calculated each month; this is then added to the principal and the payment is made. **Remember to convert the interest to the rate per month!** The interest next month is then calculated on the new amount owing.
3. To calculate the total amount to be repaid on a home loan, we multiply the monthly payment by the number of repayments made.

### EXAMPLES:

A loan of \$120 000 is paid off at 9% pa reducible interest over a period of 25 years. The monthly repayment is \$1026.05. Calculate:

- (i) the total amount made in repayments on this loan.
- (ii) the amount of interest that was charged on the loan;

# EFFECTIVE RATE OF INTEREST



Due to the various methods that a loan can be calculated, the actual interest rate quoted may not be an accurate guide to the cost of the loan.

By applying a flat rate of interest the lender can quote an interest rate less than the equivalent reducible interest rate.

To compare flat and reducible rates of interest, you must calculate the **effective rate of interest** for a **flat rate loan**. The effective rate of interest is the equivalent rate of reducible interest for a flat rate loan.

The formula for effective rate of interest is:

$$E = \frac{(1+r)^n - 1}{n}$$

where E is the effective rate of interest, expressed as a decimal;

r is the stated rate of flat interest expressed as a decimal;

n is the term of the loan in years.

Eg Belinda borrows \$8000 for a car over 5 years at 6% pa flat. Calculate the effective rate of interest charged on the loan.

eg Tom borrows \$85 000 at 10% pa reducible to be repaid over 15 years at \$913.41 per month.

- Calculate the total repayments on the loan;
- Calculate the total amount of interest paid;
- Calculate the equivalent flat rate of interest on the loan



A loan with a reducible rate of interest can be compared to a flat rate of interest if we are able to calculate the total repayments made over the term of the loan. Calculate the total interest and divide by the number of years.

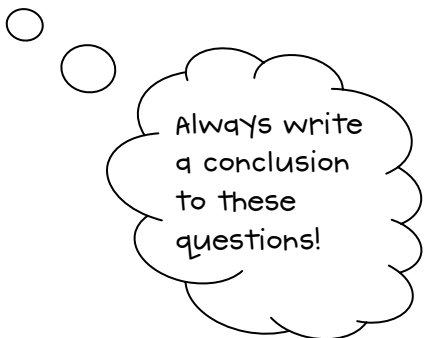


eg Gav borrows \$6000 and has narrowed her choice of loans to 2 options:

Loan A: At 8% pa flat rate of interest over 4 years to be repaid at \$165.00 per month.

Loan B: At 12% pa reducible interest over 3 years to be paid at \$199.29 per month.

Compare the 2 loans and justify which will be the more economical.



Always write  
a conclusion  
to these  
questions!

# Credit cards!

(Don't you just love them!!!!)

Eligible bank customers are allowed to use the bank's credit card facility.

## ADVANTAGES:

## DISADVANTAGES:

## TIPS TO REMEMBER:



- ☞ Some credit cards have an interest free period while others charge interest from the date of purchase.
- ☞ Cards without interest free periods generally have a lower rate of interest than those with an interest free period.
- ☞ The interest on a credit card is usually calculated as a daily rate. This is found by dividing the annual rate by 365.25.
- ☞ To consider the cheaper option, we need to consider the repayment plan of each card.

## IMPORTANT STUFF!

eg A credit card company has the following conditions:

- 💡 **There is no charge if the account is paid in full by the due date;**
- 💡 **An initial charge of 2.25% on any outstanding balance beyond the due date must be paid;**
- 💡 **An additional continuing charge of 0.07575% per day accrues on the outstanding balance until it is paid in full.**

Below is a copy of Laura's monthly statement:



DATE	TRANSACTION	\$
	Opening balance	0.00
6.8.06	M Wool and Co	158.95
7.8.06	K Electronics	345.00
8.8.06	Fashionable Fashions	405.55
25.8.06	The Corner	201.20
	Closing balance	

- a) Calculate the closing balance
- b) Calculate the interest charged if Laura repays \$200 by the due date and the remainder 25 days later.
- c) Calculate the yearly rate of interest that is charged on this credit card.



Eg Scott received a new credit card in early September. There is no interest free period on purchases and the daily interest rate is 0.0.5%. The following is his statement for September:

DATE	PURCHASE	COST
10 Sep	Books	370.00
18 Sep	Petrol	52.00
22 Sep	Restaurant	123.95

He receives an account for the month of September. What is the total interest he will be charged?

Sarah and Phoebe each use their credit cards to buy holidays to Singapore. The cost of each package is \$1900.

- The charge on Sarah's credit card is 1.5% interest per month on the unpaid balance. Sarah pays \$900 after one month and another \$900 after the next month. After her second payment, how much does she still owe for her holiday?
- Phoebe's credit card company charges no interest in the first month and 2% interest on the unpaid balance from then on. She pays \$900 after one month and another \$900 after the next month. How much does she still owe for her holiday after this second payment?



# Using Tables for Loans

	Interest rate										
Year	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%
1	\$85.61	\$86.07	\$86.53	\$86.99	\$87.45	\$87.92	\$88.38	\$88.85	\$89.32	\$89.79	\$90.26
2	\$43.87	\$44.32	\$44.77	\$45.23	\$45.68	\$46.14	\$46.61	\$47.07	\$47.54	\$48.01	\$48.49
3	\$29.97	\$30.42	\$30.88	\$31.34	\$31.80	\$32.27	\$32.74	\$33.21	\$33.69	\$34.18	\$34.67
4	\$23.03	\$23.49	\$23.95	\$24.41	\$24.89	\$25.36	\$25.85	\$26.33	\$26.83	\$27.33	\$27.83
5	\$18.87	\$19.33	\$19.80	\$20.28	\$20.76	\$21.25	\$21.74	\$22.24	\$22.75	\$23.27	\$23.79
6	\$16.10	\$16.57	\$17.05	\$17.53	\$18.03	\$18.53	\$19.03	\$19.55	\$20.07	\$20.61	\$21.15
7	\$14.13	\$14.61	\$15.09	\$15.59	\$16.09	\$16.60	\$17.12	\$17.65	\$18.19	\$18.74	\$19.30
8	\$12.66	\$13.14	\$13.63	\$14.14	\$14.65	\$15.17	\$15.71	\$16.25	\$16.81	\$17.37	\$17.95
9	\$11.52	\$12.01	\$12.51	\$13.02	\$13.54	\$14.08	\$14.63	\$15.18	\$15.75	\$16.33	\$16.92
10	\$10.61	\$11.10	\$11.61	\$12.13	\$12.67	\$13.22	\$13.78	\$14.35	\$14.93	\$15.53	\$16.13
11	\$ 9.86	\$10.37	\$10.88	\$11.42	\$11.96	\$12.52	\$13.09	\$13.68	\$14.28	\$14.89	\$15.51
12	\$ 9.25	\$ 9.76	\$10.28	\$10.82	\$11.38	\$11.95	\$12.54	\$13.13	\$13.75	\$14.37	\$15.01
13	\$ 8.73	\$ 9.25	\$ 9.78	\$10.33	\$10.90	\$11.48	\$12.08	\$12.69	\$13.31	\$13.95	\$14.60
14	\$ 8.29	\$ 8.81	\$ 9.35	\$ 9.91	\$10.49	\$11.08	\$11.69	\$12.31	\$12.95	\$13.60	\$14.27
15	\$ 7.91	\$ 8.44	\$ 8.99	\$ 9.56	\$10.14	\$10.75	\$11.37	\$12.00	\$12.65	\$13.32	\$14.00
16	\$ 7.58	\$ 8.11	\$ 8.67	\$ 9.25	\$ 9.85	\$10.46	\$11.09	\$11.74	\$12.40	\$13.08	\$13.77
17	\$ 7.29	\$ 7.83	\$ 8.40	\$ 8.98	\$ 9.59	\$10.21	\$10.85	\$11.51	\$12.19	\$12.87	\$13.58
18	\$ 7.03	\$ 7.58	\$ 8.16	\$ 8.75	\$ 9.36	\$10.00	\$10.65	\$11.32	\$12.00	\$12.70	\$13.42
19	\$ 6.80	\$ 7.36	\$ 7.94	\$ 8.55	\$ 9.17	\$ 9.81	\$10.47	\$11.15	\$11.85	\$12.56	\$13.28
20	\$ 6.60	\$ 7.16	\$ 7.75	\$ 8.36	\$ 9.00	\$ 9.65	\$10.32	\$11.01	\$11.72	\$12.44	\$13.17
21	\$ 6.42	\$ 6.99	\$ 7.58	\$ 8.20	\$ 8.85	\$ 9.51	\$10.19	\$10.89	\$11.60	\$12.33	\$13.07
22	\$ 6.25	\$ 6.83	\$ 7.43	\$ 8.06	\$ 8.71	\$ 9.38	\$10.07	\$10.78	\$11.50	\$12.24	\$12.99
23	\$ 6.10	\$ 6.69	\$ 7.30	\$ 7.93	\$ 8.59	\$ 9.27	\$ 9.97	\$10.69	\$11.42	\$12.16	\$12.92
24	\$ 5.97	\$ 6.56	\$ 7.18	\$ 7.82	\$ 8.49	\$ 9.17	\$ 9.88	\$10.60	\$11.34	\$12.10	\$12.86
25	\$ 5.85	\$ 6.44	\$ 7.07	\$ 7.72	\$ 8.39	\$ 9.09	\$ 9.80	\$10.53	\$11.28	\$12.04	\$12.81

The table shows the monthly repayment on a \$1000 loan at various interest rates over various terms.

eg Calculate the monthly repayment on a loan of \$85 000 at 11% p.a. over a 25-year term.

eg Elliott borrows \$160 000 for a home at 8% p.a. over a 20-year term. He repay the loan at \$1400 per month. If the interest rate rises to 9%, will Elliott need to increase the repayment and, if so, by how much?

## TRIAL QUESTIONS...

Jo and David took out a housing loan of \$160 000 at an interest rate of 7.2% per annum, compounding monthly. As part of their contract, they agreed to pay a monthly repayment of \$2 000. Details of the first two months of the loan are shown on the statement below.

Month	Balance on first day of the month	Monthly Interest	Monthly Repayment	Balance on last day of month
1	\$160 000.00	\$960.00	\$2 000.00	\$158 960.00
2	\$158 960.00	\$953.76	\$2 000.00	\$157 913.76

- (i) What is the monthly rate of interest?

1

- (ii) Jo and David find themselves unable to make any repayments on their housing loan during the third month. According to their contract that they have with the bank, if a repayment is not made during a particular month, then a penalty fee of 18% of the monthly repayment is to be made during the following month together with the late monthly repayment which was due as well as the current monthly repayment. Note that the penalty fee that they pay is not deducted from the balance of their loan.

- (1) How much do Jo and David have to pay the bank during the fourth month?

1

- (2) Copy and complete for the third and fourth months of the housing loan below into your writing booklet.

4

Month	Balance on first day of the month	Monthly Interest	Monthly Repayment	Balance on last day of month
1	\$160 000.00	\$960.00	\$2 000.00	\$158 960.00
2	\$158 960.00	\$953.76	\$2 000.00	\$157 913.76
3	\$157 913.76		\$0.00	
4			\$4 000.00	



## 2009 HSC

- 20 Lou bought a plasma TV which was priced at \$3499. He paid \$1000 deposit and got a loan for the balance that was paid off by 24 monthly instalments of \$135.36.

What simple interest rate per annum, to the nearest percent, was charged on his loan?

- (A) 11%
- (B) 15%
- (C) 30%
- (D) 46%

## 2009 HSC Q 23

- (d) The tables below show information about fees for MyBank accounts.

Bank fees for accounts			Withdrawal fees	
<i>Types of fees</i>	<i>Free Access Account</i>	<i>Cheap Access Account</i>	<i>Types of withdrawals</i>	<i>Fee per withdrawal</i>
Monthly account fee	\$7	\$4	Internet banking	\$0.30
Withdrawal fees	No	Yes	Cash withdrawal from MyBank ATM	\$0.50
Each cash withdrawal from other ATM	\$2	\$2	EFTPOS purchases	\$0.50

- (i) Li has a *Cheap Access Account*. During September, he made

3

- five withdrawals using internet banking
- two cash withdrawals from a MyBank ATM
- four EFTPOS purchases
- two cash withdrawals at other ATMs.

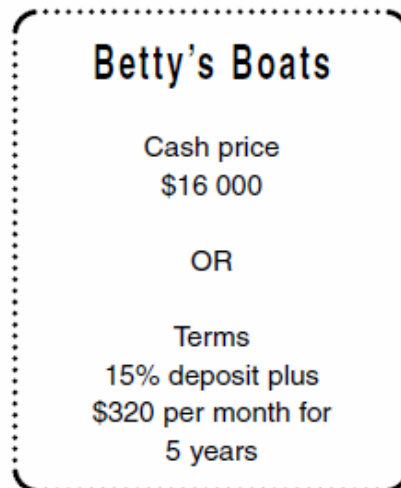
What was the total amount that Li paid in bank fees for the month of September?

- (ii) In October, what is the maximum that Li could pay in withdrawal fees to ensure that a *Cheap Access Account* costs him no more than a *Free Access Account*?

1



15 Ali is buying a speedboat at Betty's Boats.



What is the amount of interest Ali will have to pay if he chooses to buy the boat on terms?

- (A) \$3200
- (B) \$5600
- (C) \$19 200
- (D) \$21 600